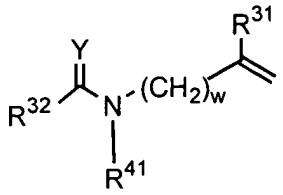
What is claimed is:

1. An antimicrobial lens comprising silver and a polymer formed from a reaction mixture comprising at least one ligand monomer of Formula I



I

wherein

w is 0-1;

Y is oxygen or sulfur;

R^{31} is hydrogen or C_{1-6}alkyl;

R^{32} is selected from the group consisting of hydroxyl, amino, sulfonic acid, phosphonic acid, carboxylic acid, thioC_{1-6}alkylcarbonyl, thioC_{1-6}alkylaminocarbonyl, $-C(O)NH-(CH_2)_d-R^{33}$, $-O-R^{33}$, $-NH-R^{33}$, $-S-(CH_2)_d-R^{33}$, $-(CH_2)_d-R^{33}$, C_{1-6}alkyldisulfide, phenyldisulfide, urea, C_{1-6}alkylurea, phenylurea, thiourea, C_{1-6}alkylthiourea, phenylthiourea, C_{1-6}alkylamine, phenylamine, substituted C_{1-6}alkyldisulfide, substituted phenyldisulfide, substituted phenylurea, substituted C_{1-6}alkylamine, substituted phenylamine, substituted phenylthiourea, substituted C_{1-6}alkylurea or substituted C_{1-6}alkylthiourea wherein the substitutents are selected from the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide, and nitrile

where

d is 0-8;

R^{33} is thioC_{1-6}alkylcarbonyl, C_{1-6}alkyl, substituted C_{1-6}alkyl where the alkyl substituents are selected from

one or more members of the group consisting of C_{1-6}alkyl, halo C_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide, nitrile, thiol, C_{1-6}alkyldisulfide, C_{1-6}alkylsulfide, phenyldisulfide, urea, C_{1-6}alkylurea, phenylurea, thiourea, C_{1-6}alkylthiourea, phenylthiourea, substituted C_{1-6}alkyldisulfide, substituted phenyldisulfide, substituted C_{1-6}alkylurea, substituted phenylurea, substituted C_{1-6}alkylthiourea or substituted phenylthiourea

wherein the C_{1-6}alkyldisulfide, phenyldisulfide, C_{1-6}alkylurea, C_{1-6}alkylthiourea, phenylurea, and phenylthiourea substituents are selected from the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide, and nitrile;

$-(CR^{34}R^{35})_q-(CHR^{36})_m-SO_3H$

where R^{34}, R^{35}, and R^{36} are independently selected from the group consisting of hydrogen, halogen, hydroxyl, and C_{1-6}alkyl,

q is 1-6, and m is 0-6;

$-(CH_2)_n-S-S-(CH_2)_xNH-C(O)CR^{37}CH_2$,

where R^{37} is hydrogen or C_{1-6}alkyl,

n is 1-6, and x is 1-6;

$-(CR^{38}R^{39})_t-(CHR^{40})_u-P(O)(OH)_2$

where R^{38}, $R3^9$, and R^{40} are independently selected from the group consisting of hydrogen, halogen, hydroxyl, and C_{1-6}alkyl,

t is 1-6, and

u is 0-6;

phenyl, benzyl, pyridinyl, pyrimidinyl, pyrazinyl,
benzimidazolyl, benzothiazolyl, benzotriazolyl, naphthaloyl,
quinolinyl, indolyl, thiadiazolyl, triazolyl,
4-methylpiperidin-1-yl, 4-methylpiperazin-1-yl,
substituted phenyl, substituted benzyl,
substituted pyridinyl, substituted pyrimidinyl,
substituted pyrazinyl, substituted benzimidazolyl,
substituted benzothiazolyl, substituted benzotriazolyl,
substituted naphthaloyl, substituted quinolinyl,
substituted indolyl, substituted thiadiazolyl,
substituted triazolyl, substituted 4-methylpiperidin-1-yl, or
substituted 4-methylpiperazin-1-yl,

wherein the substituents are selected from one or more members of the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, sulfonic acid, phosphonic acid, hydroxyl, carboxylic acid, amine, amidine, N-(2-aminopyrimidine)sulfonyl, N-(aminopyridine)sulfonyl, N-(aminopyrazine)sulfonyl, N-(2-aminopyrimidine)carbonyl, N-(aminopyridine)carbonyl, N-(aminopyrazine)carbonyl, N-(2-aminopyrimidine)phosphonyl, N-(2-aminopyridine)phosphonyl, N-(aminopyrazine)phosphonyl, N-(aminobenzimidazolyl)sulfonyl, N-(aminobenzothiazolyl)sulfonyl, N-(aminobenzotriazolyl)sulfonyl, N-(aminoindolyl)sulfonyl, N-(aminothiazolyl)sulfonyl, N-(aminotriazolyl)sulfonyl, N-(amino-4-methylpiperidinyl)sulfonyl, N-(amino-4-methylpiperazinyl)sulfonyl,

N-(aminobenzimidazolyl)carbonyl,
N-(aminobenzothiazolyl)carbonyl,
N-(aminobenzotriazolyl)carbonyl,
N-(aminoindolyl)carbonyl, N-(aminothiazolyl)carbonyl,
N-(aminotriazolyl)carbonyl,
N-(amino-4-methylpiperidinyl)carbonyl,
N-(amino-4-methylpiperazinyl)carbonyl,
N-(2-aminobenzimidazolyl)phosphonyl,
N-(2-aminobenzothiazolyl)phosphonyl,
N-(2-aminobenzotriazolyl)phosphonyl,
N-(2-aminoindolyl)phosphonyl,
N-(2-aminothiazolyl)phosphonyl,
N-(2-aminotriazolyl)phosphonyl,
N-(amino-4-methylpiperidinyl) phosphonyl,
N-(amino-4-methylpiperazinyl) phosphonyl, acetamide, nitrile, thiol, C_{1-6}alkyldisulfide, C_{1-6}alkylsulfide, phenyl disulfide, urea, C_{1-6}alkylurea, phenylurea, thiourea, C_{1-6}alkylthiourea, phenylthiourea, substituted C_{1-6}alkyldisulfide, substituted phenyldisulfide, substituted C_{1-6}alkylurea, substituted C_{1-6}alkylthiourea, substituted phenylurea, and substituted phenylthiourea wherein the C_{1-6}alkyldisulfide, phenyldisulfide, C_{1-6}alkylurea, C_{1-6}alkylthiourea, phenylurea, and phenylthiourea substituents are selected from the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide, and nitrile;

R^{41} is selected from the group consisting of hydrogen, C_{1-6}alkyl, phenyl, C_{1-6}alkylcarbonyl, phenylcarbonyl, substituted C_{1-6}alkyl, substituted phenyl, substituted C_{1-6}alkylcarbonyl and substituted phenylcarbonyl,

wherein

the substituents are selected from the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide, and nitrile

wherein the silver is releasably bound to the ligand, and the silver is present in the lens in an amount, expressed as a ratio of silver to ligand monomer of at least about 0.6.

2. The antimicrobial lens of claim 1 wherein,

w is 0-1;

R^{31} is hydrogen;

R^{32} is selected from the group consisting of amine, C_{1-3}alkylamine, phenylamine, substituted phenylamine, thioC_{1-3}alkylcarbonyl; and

R^{41} is hydrogen

3. The antimicrobial lens of claim 1 wherein the lens is a soft contact lens.

4. The antimicrobial lens of claim 1 wherein the monomer of Formula I is present at about 0.01 to about 1.5 weight percent.

5. The antimicrobial lens of claim 1 wherein the ligand monomer is present at about 0.01 to about 0.8 weight percent.

6. The antimicrobial lens of claim 1 wherein the ligand monomer is present at about 0.01 to about 0.3 weight percent.

7. The antimicrobial lens of claim 1 wherein the ligand monomer is present at about 0.01 to about 0.2 weight percent.

8. The antimicrobial lens of claim 1 wherein the ratio of silver to ligand

monomer is at least about 0.8.

9. The antimicrobial lens of claim 1 wherein the lens is a silicone hydrogel.

10. The antimicrobial lens of claim 1 wherein, the lens is etafilcon A, balafilcon, A, acquafilcon A, lenefilcon A, galyfilcon, senofilcon or lotrafilcon A.

11. The antimicrobial lens of claim 1 wherein,

R^1, R^4, R^5, R^6, R^8, R^9 and R^{10} are independently hydrogen or methyl;

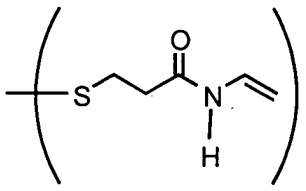
R^2 is NH-R^3;

R^3 is $-(CR^4\ R^5)_q-(CHR^6)_m-SO_3H$, $-(CR^8R^9)_t-(CHR^{10})_u-P(O)(OH)_2$ or $-(CH_2)_n-S-S-(CH_2)_xNH-C(O)CHR^7CH_2$;

q is 1-2; m is 1-2; R^7 is hydrogen; t is 1; u is 1-2; n is 2-3; and

x is 2-3.

12. The antimicrobial lens of claim 1 wherein the monomer of Formula I is selected from the group consisting of 1-allyl-2 thiourea and the following monomers



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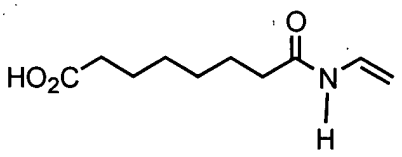

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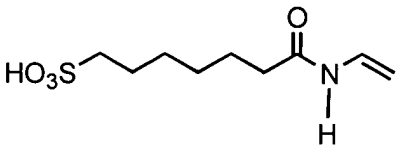
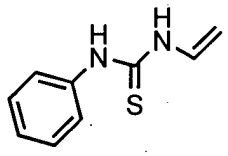


, and



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13. The antimicrobial lens of claim 1 wherein silver is present at about 60 ppm to about 4,000 ppm.

14. The antimicrobial lens of claim 1 wherein silver is present at about 60

ppm to about 2,000 ppm.

15. The antimicrobial lens of claim 1 wherein silver is present at about 60 ppm to about 1,000 ppm.

16. The antimicrobial lens of claim 1 wherein the lens is a silicone hydrogel and the ligand monomer is 1-allyl-2-thiourea.

17. The antimicrobial lens of claim 16 wherein silver is present at about 60 ppm to about 4000 ppm and the ligand monomer is present at about 0.01 to about 1.5 weight percent.

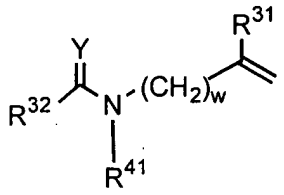
18. The antimicrobial lens of claim 1 wherein the lens is etafilcon A, balafilcon, A, acquafilcon A, lenefilcon, galyfilcon, senofilcon or lotrafilcon A and the ligand monomer is 1-allyl-2-thiourea.

19. The antimicrobial lens of claim 18 wherein silver is present at about 60 ppm to about 2000 ppm and the ligand monomer is present at about 0.01 to about 1.5 weight percent.

20. The antimicrobial lens of claim 19 wherein the lens is etafilcon A or acquafilcon A.

21. The lens of claim 20 wherein silver is present at about 60 ppm to about 1000 ppm.

22. A method of producing an antimicrobial lens comprising, silver and a polymer comprising at least one ligand monomer of Formula I



I

wherein

w is 0-1;

Y is oxygen or sulfur;

R^{31} is hydrogen or C_{1-6}alkyl;

R^{32} is selected from the group consisting of hydroxyl, amino, sulfonic acid, phosphonic acid, carboxylic acid, thioC_{1-6}alkylcarbonyl, thioC_{1-6}alkylaminocarbonyl, -C(O)NH-$(CH_2)_d$-R^{33}, -O-R^{33}, -NH-R^{33}, -S-$(CH_2)_d$-R^{33}, -$(CH_2)_d$-R^{33}, C_{1-6}alkyldisulfide, phenyldisulfide, urea, C_{1-6}alkylurea, phenylurea, thiourea, C_{1-6}alkylthiourea, phenylthiourea, C_{1-6}alkylamine, phenylamine, substituted C_{1-6}alkyldisulfide, substituted phenyldisulfide, substituted phenylurea, substituted C_{1-6}alkylamine, substituted phenylamine, substituted phenylthiourea, substituted C_{1-6}alkylurea or substituted C_{1-6}alkylthiourea wherein the substitutents are selected from the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide, and nitrile

where

d is 0-8;

R^{33} is thioC_{1-6}alkylcarbonyl, C_{1-6}alkyl, substituted C_{1-6}alkyl where the alkyl substituents are selected from one or more members of the group consisting of C_{1-6}alkyl, halo C_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide, nitrile, thiol,

C_{1-6}alkyldisulfide, C_{1-6}alkylsulfide, phenyldisulfide, urea, C_{1-6}alkylurea, phenylurea, thiourea, C_{1-6}alkylthiourea, phenylthiourea, substituted C_{1-6}alkyldisulfide, substituted phenyldisulfide, substituted C_{1-6}alkylurea, substituted phenylurea, substituted C_{1-6}alkylthiourea or substituted phenylthiourea

wherein the C_{1-6}alkyldisulfide, phenyldisulfide, C_{1-6}alkylurea, C_{1-6}alkylthiourea, phenylurea, and phenylthiourea substituents are selected from the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide, and nitrile;

$-(CR^{34}R^{35})_q-(CHR^{36})_m-SO_3H$

where R^{34}, R^{35}, and R^{36} are independently selected from the group consisting of hydrogen, halogen, hydroxyl, and C_{1-6}alkyl,

q is 1-6, and m is 0-6;

$-(CH_2)_n-S-S-(CH_2)_xNH-C(O)CR^{37}CH_2$,

where R^{37} is hydrogen or C_{1-6}alkyl,

n is 1-6, and x is 1-6;

$-(CR^{38}R^{39})_t-(CHR^{40})_u-P(O)(OH)_2$

where R^{38}, $R3^9$, and R^{40} are independently selected from the group consisting of hydrogen, halogen, hydroxyl, and C_{1-6}alkyl,

t is 1-6, and

u is 0-6;

phenyl, benzyl, pyridinyl, pyrimidinyl, pyrazinyl, benzimidazolyl, benzothiazolyl, benzotriazolyl, naphthaloyl, quinolinyl, indolyl, thiadiazolyl, triazolyl,

4-methylpiperidin-1-yl, 4-methylpiperazin-1-yl,
substituted phenyl, substituted benzyl,
substituted pyridinyl, substituted pyrimidinyl,
substituted pyrazinyl, substituted benzimidazolyl,
substituted benzothiazolyl, substituted benzotriazolyl,
substituted naphthaloyl, substituted quinolinyl,
substituted indolyl, substituted thiadiazolyl,
substituted triazolyl, substituted 4-methylpiperidin-1-yl, or
substituted 4-methylpiperazin-1-yl,

wherein the substituents are selected from one or more members of the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, sulfonic acid, phosphonic acid, hydroxyl, carboxylic acid, amine, amidine, N-(2-aminopyrimidine)sulfonyl, N-(aminopyridine)sulfonyl, N-(aminopyrazine)sulfonyl, N-(2-aminopyrimidine)carbonyl, N-(aminopyridine)carbonyl, N-(aminopyrazine)carbonyl, N-(2-aminopyrimidine)phosphonyl, N-(2-aminopyridine)phosphonyl, N-(aminopyrazine)phosphonyl, N-(aminobenzimidazolyl)sulfonyl, N-(aminobenzothiazolyl)sulfonyl, N-(aminobenzotriazolyl)sulfonyl, N-(aminoindolyl)sulfonyl, N-(aminothiazolyl)sulfonyl, N-(aminotriazolyl)sulfonyl, N-(amino-4-methylpiperidinyl)sulfonyl, N-(amino-4-methylpiperazinyl)sulfonyl, N-(aminobenzimidazolyl)carbonyl, N-(aminobenzothiazolyl)carbonyl, N-(aminobenzotriazolyl)carbonyl, N-(aminoindolyl)carbonyl, N-(aminothiazolyl)carbonyl,

N-(aminotriazolyl)carbonyl,
N-(amino-4-methylpiperidinyl)carbonyl,
N-(amino-4-methylpiperazinyl)carbonyl,
N-(2-aminobenzimidazolyl)phosphonyl,
N-(2-aminobenzothiazolyl)phosphonyl,
N-(2-aminobenzotriazolyl)phosphonyl,
N-(2-aminoindolyl)phosphonyl,
N-(2-aminothiazolyl)phosphonyl,
N-(2-aminotriazolyl)phosphonyl,
N-(amino-4-methylpiperidinyl) phosphonyl,
N-(amino-4-methylpiperazinyl) phosphonyl, acetamide, nitrile, thiol, C_{1-6}alkyldisulfide, C_{1-6}alkylsulfide, phenyl disulfide, urea, C_{1-6}alkylurea, phenylurea, thiourea, C_{1-6}alkylthiourea, phenylthiourea, substituted C_{1-6}alkyldisulfide, substituted phenyldisulfide, substituted C_{1-6}alkylurea, substituted C_{1-6}alkylthiourea, substituted phenylurea, and substituted phenylthiourea

wherein the C_{1-6}alkyldisulfide, phenyldisulfide, C_{1-6}alkylurea, C_{1-6}alkylthiourea, phenylurea, and phenylthiourea substituents are selected from the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide, and nitrile;

R^{41} is selected from the group consisting of hydrogen, C_{1-6}alkyl, phenyl, C_{1-6}alkylcarbonyl, phenylcarbonyl, substituted C_{1-6}alkyl, substituted phenyl, substituted C_{1-6}alkylcarbonyl and substituted phenylcarbonyl,

wherein

the substituents are selected from the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide,

and nitrile

where the method comprises the steps of

(a) preparing a lens comprising at least one ligand monomer and

(b) treating the lens with a silver solution of a concentration to provide the lens with a silver to ligand monomer ratio of at least about 0.6.

23. The method of claim 22 wherein the silver solution is aqueous silver nitrate having a concentration of about 0.1 µg/mL to about 0.3 g/mL.

24. The method of claim 22 wherein, the treating step comprises soaking the lens in the silver solution.

25. The method of claim 24 wherein, the lens is soaked in the silver solution for about 2 minutes to about 2 hours.

26. The method of claim 22 wherein, the treating step comprises storing the lens in a silver solution for about 20 minutes to about 5 years.

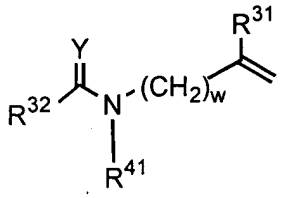
27. The method of claim 22 wherein the ratio of silver to ligand monomer is at least about 0.8.

28. The lens of claim 1 wherein said lens displays at least about a 0.4 log reduction in microbial activity.

29. The lens of claim 1 wherein said lens displays at least about a 1 log reduction in microbial activity..

30. A lens case comprising silver and a polymer comprising at least one ligand monomer of Formula I

of Formula I



I

wherein

w is 0-1;

Y is oxygen or sulfur;

R^{31} is hydrogen or C_{1-6}alkyl;

R^{32} is selected from the group consisting of hydroxyl, amino, sulfonic acid, phosphonic acid, carboxylic acid, thioC_{1-6}alkylcarbonyl, thioC_{1-6}alkylaminocarbonyl, -C(O)NH-$(CH_2)_d$-R^{33}, -O-R^{33}, -NH-R^{33}, -S-$(CH_2)_d$-R^{33}, -$(CH_2)_d$-R^{33}, C_{1-6}alkyldisulfide, phenyldisulfide, urea, C_{1-6}alkylurea, phenylurea, thiourea, C_{1-6}alkylthiourea, phenylthiourea, C_{1-6}alkylamine, phenylamine, substituted C_{1-6}alkyldisulfide, substituted phenyldisulfide, substituted phenylurea, substituted C_{1-6}alkylamine, substituted phenylamine, substituted phenylthiourea, substituted C_{1-6}alkylurea or substituted C_{1-6}alkylthiourea wherein the substitutents are selected from the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide, and nitrile

where

d is 0-8;

R^{33} is thioC_{1-6}alkylcarbonyl, C_{1-6}alkyl, substituted C_{1-6}alkyl where the alkyl substituents are selected from one or more members of the group consisting of C_{1-6}alkyl, halo C_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid,

amine, amidine, acetamide, nitrile, thiol, C_{1-6}alkyldisulfide, C_{1-6}alkylsulfide, phenyldisulfide, urea, C_{1-6}alkylurea, phenylurea, thiourea, C_{1-6}alkylthiourea, phenylthiourea, substituted C_{1-6}alkyldisulfide, substituted phenyldisulfide, substituted C_{1-6}alkylurea, substituted phenylurea, substituted C_{1-6}alkylthiourea or substituted phenylthiourea

wherein the C_{1-6}alkyldisulfide, phenyldisulfide, C_{1-6}alkylurea, C_{1-6}alkylthiourea, phenylurea, and phenylthiourea substituents are selected from the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide, and nitrile;

$-(CR^{34}R^{35})_q-(CHR^{36})_m-SO_3H$

where R^{34}, R^{35}, and R^{36} are independently selected from the group consisting of hydrogen, halogen, hydroxyl, and C_{1-6}alkyl,

q is 1-6, and m is 0-6;

$-(CH_2)_n-S-S-(CH_2)_xNH-C(O)CR^{37}CH_2$,

where R^{37} is hydrogen or C_{1-6}alkyl,

n is 1-6, and x is 1-6;

$-(CR^{38}R^{39})_t-(CHR^{40})_u-P(O)(OH)_2$

where R^{38}, $R3^9$, and R^{40} are independently selected from the group consisting of hydrogen, halogen, hydroxyl, and C_{1-6}alkyl,

t is 1-6, and

u is 0-6;

phenyl, benzyl, pyridinyl, pyrimidinyl, pyrazinyl, benzimidazolyl, benzothiazolyl, benzotriazolyl, naphthaloyl,

quinolinyl, indolyl, thiadiazolyl, triazolyl,
4-methylpiperidin-1-yl, 4-methylpiperazin-1-yl,
substituted phenyl, substituted benzyl,
substituted pyridinyl, substituted pyrimidinyl,
substituted pyrazinyl, substituted benzimidazolyl,
substituted benzothiazolyl, substituted benzotriazolyl,
substituted naphthaloyl, substituted quinolinyl,
substituted indolyl, substituted thiadiazolyl,
substituted triazolyl, substituted 4-methylpiperidin-1-yl, or
substituted 4-methylpiperazin-1-yl,

wherein the substituents are selected from one or more members of the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, sulfonic acid, phosphonic acid, hydroxyl, carboxylic acid, amine, amidine, N-(2-aminopyrimidine)sulfonyl, N-(aminopyridine)sulfonyl, N-(aminopyrazine)sulfonyl, N-(2-aminopyrimidine)carbonyl, N-(aminopyridine)carbonyl, N-(aminopyrazine)carbonyl, N-(2-aminopyrimidine)phosphonyl, N-(2-aminopyridine)phosphonyl, N-(aminopyrazine)phosphonyl, N-(aminobenzimidazolyl)sulfonyl, N-(aminobenzothiazolyl)sulfonyl, N-(aminobenzotriazolyl)sulfonyl, N-(aminoindolyl)sulfonyl, N-(aminothiazolyl)sulfonyl, N-(aminotriazolyl)sulfonyl, N-(amino-4-methylpiperidinyl)sulfonyl, N-(amino-4-methylpiperazinyl)sulfonyl, N-(aminobenzimidazolyl)carbonyl, N-(aminobenzothiazolyl)carbonyl, N-(aminobenzotriazolyl)carbonyl,

N-(aminoindolyl)carbonyl, N-(aminothiazolyl)carbonyl, N-(aminotriazolyl)carbonyl, N-(amino-4-methylpiperidinyl)carbonyl, N-(amino-4-methylpiperazinyl)carbonyl, N-(2-aminobenzimidazolyl)phosphonyl, N-(2-aminobenzothiazolyl)phosphonyl, N-(2-aminobenzotriazolyl)phosphonyl, N-(2-aminoindolyl)phosphonyl, N-(2-aminothiazolyl)phosphonyl, N-(2-aminotriazolyl)phosphonyl, N-(amino-4-methylpiperidinyl) phosphonyl, N-(amino-4-methylpiperazinyl) phosphonyl, acetamide, nitrile, thiol, C_{1-6}alkyldisulfide, C_{1-6}alkylsulfide, phenyl disulfide, urea, C_{1-6}alkylurea, phenylurea, thiourea, C_{1-6}alkylthiourea, phenylthiourea, substituted C_{1-6}alkyldisulfide, substituted phenyldisulfide, substituted C_{1-6}alkylurea, substituted C_{1-6}alkylthiourea, substituted phenylurea, and substituted phenylthiourea

wherein the C_{1-6}alkyldisulfide, phenyldisulfide, C_{1-6}alkylurea, C_{1-6}alkylthiourea, phenylurea, and phenylthiourea substituents are selected from the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, hydroxyl, carboxylic acid, sulfonic acid, phosphonic acid, amine, amidine, acetamide, and nitrile;

R^{41} is selected from the group consisting of hydrogen, C_{1-6}alkyl, phenyl, C_{1-6}alkylcarbonyl, phenylcarbonyl, substituted C_{1-6}alkyl, substituted phenyl, substituted C_{1-6}alkylcarbonyl and substituted phenylcarbonyl,

wherein

the substituents are selected from the group consisting of C_{1-6}alkyl, haloC_{1-6}alkyl, halogen, hydroxyl, carboxylic acid,

sulfonic acid, phosphonic acid, amine, amidine, acetamide, and nitrile.